

DR-2700 DIGITAL MAGNETIC TAPE SYSTEM



CEC

DATA RECORDERS DIVISION

CONSOLIDATED ELECTRODYNAMICS CORPORATION

DR-2700
DIGITAL
MAGNETIC TAPE SYSTEM

DESCRIPTION

Consolidated's Type DR-2700 Vacuum-Buffered Digital Magnetic Tape System was designed for on-line and off-line digital computer usage. It is excellent for peripheral data handling applications where superior data transfer reliability and ability to withstand extended periods of heavy usage with a minimum of maintenance are requirements. Transport and the read/write electronics (optional) are completely transistorized and modular. The DR-2700 transport is available as a self-contained unit for 19-inch RETMA mounting or in a full system configuration. A system is created by the addition of such optional items as magnetic heads, control panel, read and/or write electronics, cabinet, and other user-specified features.

Although developed and produced to commercial specifications, the DR-2700 has been successfully employed in military data processing systems.

TRANSPORT

The standard DR-2700 Transport is capable of bidirectional single or 2:1 speeds up to 150 inches per second and can be adapted for use with either one-half-inch or one-inch Mylar magnetic tapes on 10½" diameter reels. Considerable attention has been given to the design of rugged drive and brake actuators for continuous and unrestricted operation at high command rates and with random command



A complete 16-channel digital record and reproduce system can be housed in this 72-inch high RETMA cabinet.

sequencing. Circuit or programmed delays to protect the transport or the tape within the maximum specified cycling rates are not needed. Command circuits are interlocked to prevent response to contradictory simultaneous commands. No thyratrons or brush-type motors are used resulting in a low-noise singly grounded system. In the event of malfunction or power failure, fail-safe brakes are energized to prevent spillage of tape or damage to the transport.

Standard features of the transport include: conductive end-of-tape sensors; rewind-to-reverse switch; leader lock and interlock assembly (permitting use of pre-threaded leader and quick-disconnect tabs for fast reel change); safety interlocks; dust cover door and sound baffle; a rigid 19-inch RETMA transport mounting frame; and anti-tapewrap shields on the capstans. Form C contacts are available for external indication of Power, Ready, and conductive beginning or end of tape. The transport provides its own self-contained and removable power supply operating from 117 v a-c single phase transformer isolated power.

Optional features available for the transport include: dual photoelectric EOT and BOT sensors; IBM reel hub adapters; file protect switch; and elapsed time meter.

Normal mounting of the transport servo electronics door requires rear access; front-access mounting is available at extra cost. Transport weight is distributed in such a manner that physical stability, even with the tape deck open for maintenance, is assured; use of skids, weights, or floor bolts is not necessary in any mounting attitude.

A control panel is available as an optional accessory; it provides manual as well as remote operation along with power, ready, leader drive, and manual/automatic switching. If manual functions are not required, the remote commands may be fed directly to the transport.

VACUUM AND AUXILIARY TAPE STORAGE

The DR-2700 is equipped with short but efficient dual vacuum tape storage chambers augmented by low-inertia tape storage arms which provide an additional 80 inches of

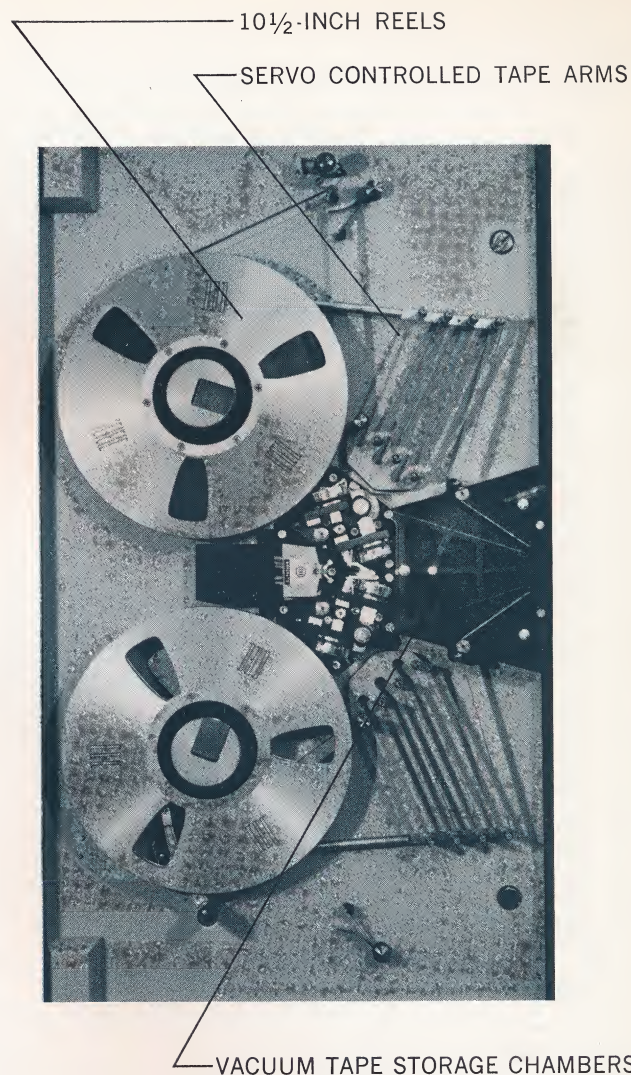


(Top) Battery of CEC digital magnetic tape recorders are part of Sylvania's 9400 computer system in use at a government installation in Washington, D.C.

storage each. Because of unique construction, no tape length sensing is necessary in the vacuum chambers; a continuous error signal is derived from long-life wire-wound potentiometers on the arm shafts and is combined with a bias from the commands to give smooth control over tape motion via a solid-state servo motor drive circuit. A constant net steady-state tape tension is maintained throughout the system for uniform tape packing on the reels. The buildup of electrostatic charges on the tape, a common tendency in vacuum columns, is precluded by a low-friction metallic tape guidance path and single-grounding techniques. Vacuum for the storage chambers is derived from a positive displacement vane-type pump driven by an induction motor.

READ AND WRITE ELECTRONICS (OPTIONAL)

All circuits are fully transistorized and are mounted on removable and interchangeable glass epoxy printed circuit cards. Test points are brought out at the leading edge for signal monitoring. Write amplifiers utilize NRZ-I recording techniques; i.e., flux changes from one state of saturation to the other on successive binary ones. Peak detection read electronics is employed for maximum reliability. Skew correction, clocking, parity, and special input/output circuits are available. (For standard I/O signal characteristics, see DR-2700 General Specification insert sheet.) A separate solid-state power supply is available and will power up to sixteen channels of read and write electronics. Electronics can be mounted in the same or an adjacent cabinet. All DR-2700 systems which include electronics are shipped with a card extender and a card extractor tool.



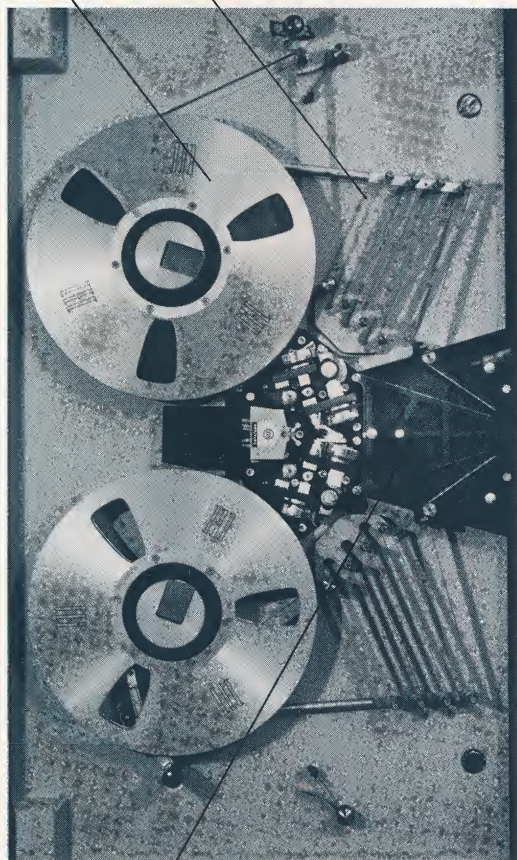
(above) Front view of the DR-2700. Dust cover door swings open for full access to tape threading path.

(right) Optional read and write amplifiers are mounted on 5 1/2" x 5 1/2" glass epoxy plug-in cards. Each card holder assembly requires 7" of vertical rack space.

(below) A control panel is available for manual or automatic operation. Tape motion is rotary-switch controlled. Panel requires 5 1/4" of vertical rack space.



10½-INCH REELS
SERVO CONTROLLED TAPE ARMS



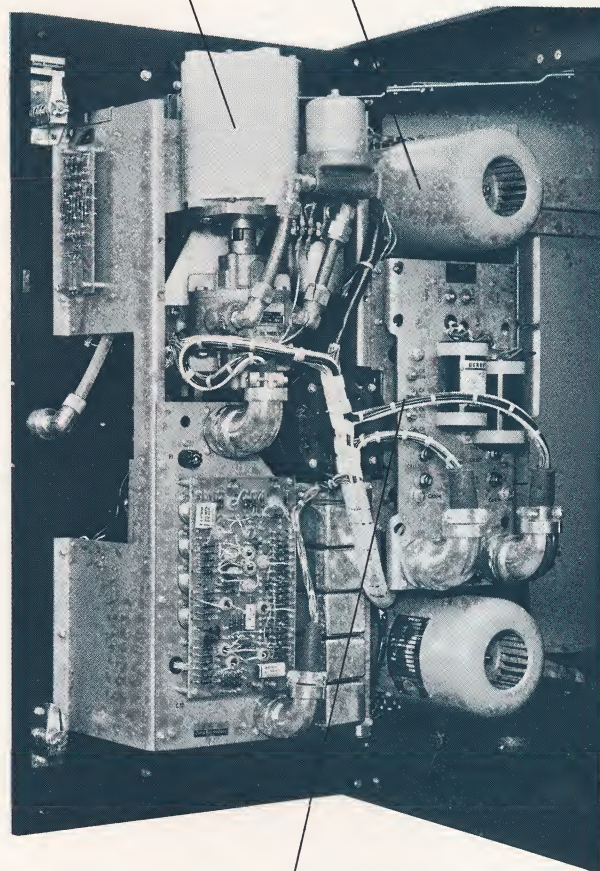
VACUUM TAPE STORAGE CHAMBERS

(above) Front view of the DR-2700. Dust cover door swings open for full access to tape threading path.

(right) Optional read and write amplifiers are mounted on 5½" x 5½" glass epoxy plug-in cards. Each card holder assembly requires 7" of vertical rack space.

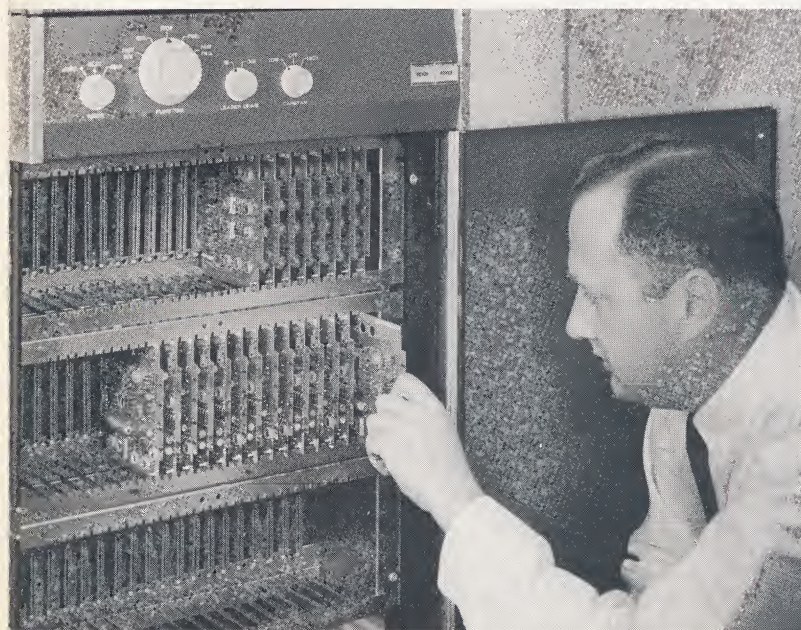
(below) A control panel is available for manual or automatic operation. Tape motion is rotary-switch controlled. Panel requires 5¼" of vertical rack space.

VACUUM BLOWER
REEL MOTOR



TRANSPORT POWER SUPPLY

(above) The Transport is designed to swing out from its mounting frame and can be operated in this position for front-access adjustment and maintenance.





(Top) Battery of CEC digital magnetic tape recorders are part of Sylvania's 9400 computer system in use at a government installation in Washington, D.C.

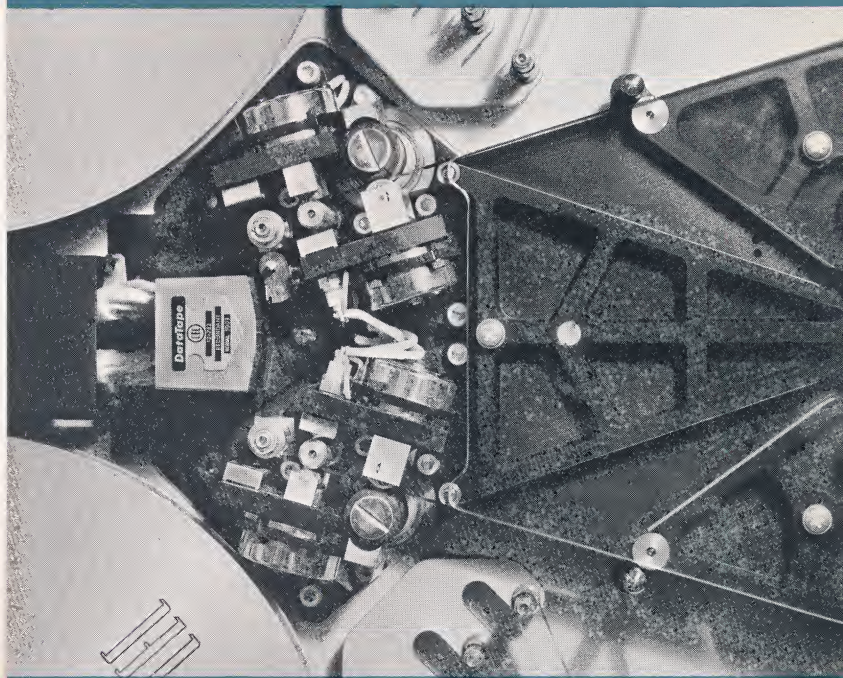
storage each. Because of unique construction, no tape length sensing is necessary in the vacuum chambers; a continuous error signal is derived from long-life wire-wound potentiometers on the arm shafts and is combined with a bias from the commands to give smooth control over tape motion via a solid-state servo motor drive circuit. A constant net steady-state tape tension is maintained throughout the system for uniform tape packing on the reels. The buildup of electrostatic charges on the tape, a common tendency in vacuum columns, is precluded by a low-friction metallic tape guidance path and single-grounding techniques. Vacuum for the storage chambers is derived from a positive displacement vane-type pump driven by an induction motor.

READ AND WRITE ELECTRONICS (OPTIONAL)

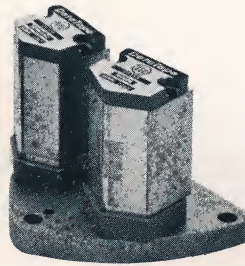
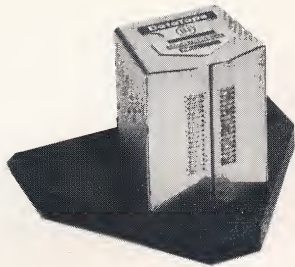
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PRINCIPAL FEATURES

*Completely transistorized
Vacuum tape storage for gentle tape handling
Short and repeatable start/stop times and distances
Designed for on/off line computer and peripheral usage
Dependable block-format operation
Computer reliability
No programming restrictions up to 150 ips
CEC built all-metal-front-surface heads
IBM compatibility
Densities up to 555.5 bits per inch NRZ-I
RETMA 19" rack or cabinet mounting
Complete line of optional accessories*



Head, actuators, and vacuum storage chambers.



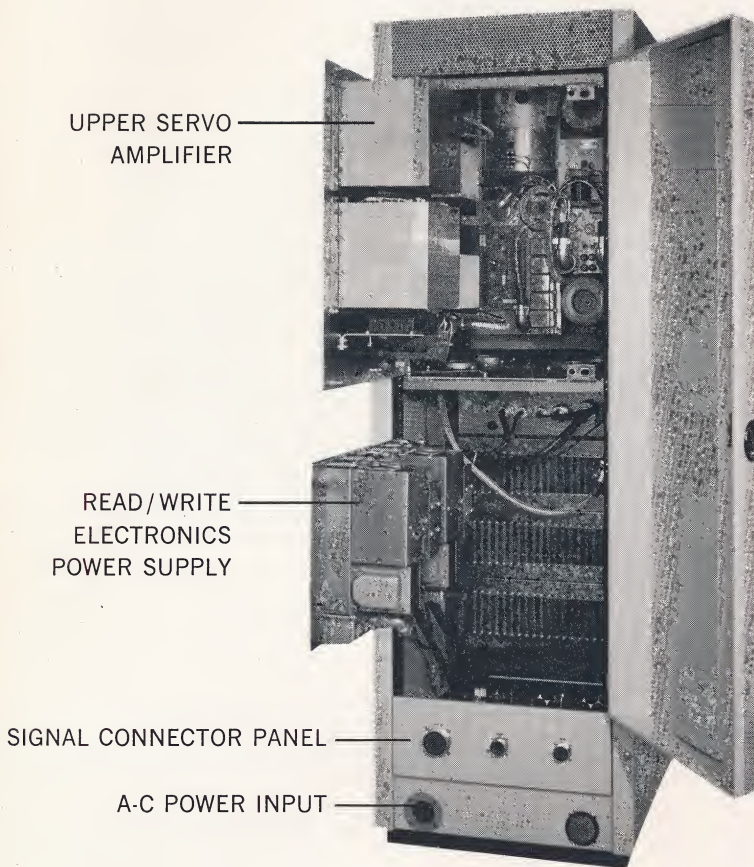
MAGNETIC HEADS

CEC magnetic headstacks feature all-metal-front-surface construction. Standard write, read, and redundant (read-after-write) configurations are available in 7, 8, or 16 track in-line arrangements for one-half or one-inch tape widths. Headstacks are separately or redundantly mounted on a precision plate and can be interchanged without special adjustment. Redundant headstacks are magnetically isolated and the separate shielded head cables are grounded at the electronics rack to eliminate ground loops. Pole faces and brackets are physically peaked for improved tape-to-head contact, even at the low tape tension inherent in the DR-2700 Transport; this also contributes to lengthened tape and head life. Precise skew guidance over the heads is obtained by referencing the tape to the inside edge of precision guide rollers adjacent to the heads; this is essentially "rolling edge guidance."

IBM 727- and IBM 729-compatible headstacks are available and will permit fully IBM-compatible tapes to be written and/or read.

CABINET

The DR-2700 is available in a standard CEC-styled 19" RETMA cabinet (see photo). Cabinet accessories such as front and rear doors, filter and grill, signal connector panel, and a 1000 cfm blower are also available. The cabinet is 71 3/4" high, 27" deep and 23" wide (19" RETMA opening). The blower maintains a slight positive pressure in the cabinet to discourage the entry of incidental dust and dirt. The cabinet will accommodate a full 16-channel read/write system with extra space for customer circuitry. It is not necessary to bolt the cabinet to the floor when mounting the DR-2700. The cabinet may be provided with a four-wheel dolly on special order. Empty cabinets are available as companion items to the DR-2700 system for customer equipment.



Rear view

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Albuquerque, N.M.
525 San Pedro Blvd., N.E.

Arlington, Virginia
764 23rd St., S.

Bellevue, Washington
808 106th Ave., N.E.

Chicago, Illinois
2540 W. Peterson Ave.

Columbus, Ohio
1350 West Fifth Ave.

Dallas, Texas
433 Regal Row

Denver, Colorado
2120 S. Birch St.

Encino, California
16033 Ventura Blvd.

Hasbrouck Heights, N.J.
345 Boulevard

Huntsville, Alabama
3322 S. Memorial Parkway

Los Altos, California
900 N. San Antonio Rd.

Needham Heights, Mass.
45 Fourth Ave.

Pasadena, California
1095 E. Green St.

Philadelphia, Penn.
101 N. 33rd St.

Salt Lake City, Utah
48 E. Robert Ave.

San Diego, California
3266 Rosecrans St.

St. Louis, Missouri
1401 Brentwood Blvd.

Seattle, Washington
302 Second Ave., West

Winter Park, Florida
501 Park Ave., North

International Division
360 Sierra Madre Villa
Pasadena, California

Consolidated Electrodynamics Division
14 Commercial
Woking, Surrey, England

CEC/GmbH
Neu-mainzerstrasse 14/16
Frankfurt/Main, Germany

GENERAL SPECIFICATIONS / DR-2700 DIGITAL MAGNETIC TAPE SYSTEM

TAPE TRANSPORT

Tape Speeds: (1) The following single or 2:1 speed ratios are standard: 150/75, 120/60, 112.5/56.25, 110/55, 100/50, 90/45, 60/30 ips.

(2) Other single or 2:1 speed ratios available from 30 to 150 ips on special order.

(3) All 2:1 speed ratios are switch-selectable from the control panel which is separately located and optional.

Tape Flutter: All speeds accurate to $\pm 2\%$ of nominal value at any speed and under steady run conditions at a constant line frequency of 60 cps.

Rewind Speed: In FAST FORWARD or REWIND, tape is transported at 250 ips nominal under servo motor control (i.e., non-capstan). Full 3600-foot reel rewinds in less than 3 minutes.

Reel Size: (1) Standard: Any 10½-inch diameter EIA (NARTB) reel, ½- or 1-inch width, or CEC precision reels.

(2) IBM (Optional): Any 10½-inch diameter IBM reel or compatible reel to IBM specifications, through use of reel hub adaptors. (Lever-operated hubs for (1) and (2) permit fast reel change.)

Tape Widths: Will handle ½"- or 1"-width Mylar tape $\left(\begin{matrix} +0.000 \\ -0.004 \text{ inch} \end{matrix} \right)$. Hard binder, high-resolution tape such as Minnesota Mining and Manufacturing, 3M498 or 3M499 recommended. Tape width kit changes can be effected as a factory modification.

Tape Thickness: Will handle 1.0 or 1.5 mil thick Mylar tape.

Tape Tension: Through use of a dual vacuum chamber augmented by low-inertia storage arms, design tape tension (for minimum head and tape wear) is maintained in all modes of operation.

Tape Handling: Operation of the transport is totally symmetrical in FORWARD and REVERSE modes. (Reading may be accomplished bidirectionally.)

Tape Sensing: (1) In vacuum chambers, none required.

(2) On storage arms, by immediate and continuous error sensing derived from potentiometers on the arm shafts plus pre-bias from the commands.

End-of-Tape Sensing: (1) Conductive beginning-of-tape (BOT) and end-of-tape (EOT) sensor posts are provided and are responsive to conductive (i.e., silver) coated Mylar leader spliced onto each end of the tape to stop transport (Standard).

(2) Photoelectric end-of-tape sensor, dual, for detection of reflective tabs affixed to Mylar side of tape by customer. Identical sensor for ½-inch or 1-inch tape widths. Will give +10 volt output externally while tab is under the sensor. Will sense IBM Load Point and End-of-File tabs. Located approximately 0.40 inch before write head gap line assuming redundant head; approximate 0.50 inch before head gap line for read-only or write-only heads (optional).

Control: Requires +10 volt levels for duration of command on FORWARD, REVERSE, FAST FORWARD, or REWIND lines; STOP is absence of above commands.

Programming: No program restrictions under any cycling conditions or tape speeds up to 150 ips and 200 commands per second (i.e., 5 milliseconds between commands, minimum) at line voltage of 117 v a-c. Command circuitry interlocked to prevent response to contradictory simultaneous commands. No program or circuit delays necessary to protect system under conditions above.

Start Time: 3.0 milliseconds or less to $\pm 15\%$ of nominal speed after FORWARD or REVERSE command.

3.5 milliseconds or less to $\pm 10\%$ point

4.0 milliseconds or less to $\pm 5\%$ point

Stop Time: 2.5 milliseconds or less after STOP command to complete tape halt. (Tape positively braked.)

Start Distance: 0.38 \pm 0.03 inch at 3.5 milliseconds (150 ips).

Stop Distance: 0.15 \pm 0.03 inch to complete halt (150 ips).

Turnaround Time: 6.0 milliseconds or less from nominal speed in one direction to $\pm 15\%$ of nominal in the other, measured from time of turnaround command.

Motors: (1) Reel: Two-phase linear servo-controlled.

(2) Capstan: Two-speed hysteresis synchronous.

(3) Vacuum: Induction 1/6 hp coupled to positive displacement vacuum pump.

(4) Muffin fan, for internal air circulation over servo electronics.

Safety Features: Dust cover door interlock switch is provided to drop transport out of READY when door is open. Limit switches are provided on the storage arms to remove drive in the event of taut or slack tape. In the event of an emergency power failure or for either aforementioned condition, fail-safe brakes are engaged to prevent damage to or spillage of tape. Anti-wrap shields protect against "tape wrap" at the capstan before tape can be damaged.

Included Accessories: (1) Rewind-to-Reverse Assembly: comprised of follower arm and switch on takeup reel; effects automatic conversion from REWIND mode to capstan-controlled REVERSE mode near beginning of tape.

(2) Leader Lock and Interlock Assembly: clamps permanently threaded leader and removes transport from READY, permitting use of quick-disconnect tabs for fast reel change.

(3) Dust cover door: restricts entry of dust and dirt, protects personnel from moving parts, and deadens operational sound.

Interchannel Time Displacement: Total time displacement at 150 ips between outer channels is 4.0 microseconds for ½-inch tape and 8.0 microseconds for 1-inch tape.

Optional Accessories: (1) Photoelectric end-of-tape sensor assembly.
 (2) Running time meter.
 (3) IBM Reel Hub Adaptors.
 (4) IBM File Protect Switch.
 (5) Manual/Remote Control Panel (separate from transport).
 (6) Read and write electronics, electronics power supply (separate from transport).

Power Supply: Self-contained, removable, solid-state. Requires 117 v a-c, 60 cycle, 2.5 KVA max.

Dimensions: Height, 33 $\frac{1}{4}$ inches.
 Width, 19 inches (RETMA mountable).
 Depth, 27 inches overall including rear servo electronics panel (19 $\frac{5}{8}$ inches rail to rail).

Weight: Transport assembly and rigid mounting frame: 225 pounds approx.
 Transport rear servo electronics panel: 100 pounds approx.
 Dust cover door: 20 pounds approx.

HEADS

CEC all-metal-front-surface magnetic headstacks are utilized. Standard 7-channel IBM 727, 7-channel IBM 729 IV, 8-channel or 16-channel read only, write only, or redundant (read after write) in-line headstacks are available.

Gap Scatter: Falls within two parallel lines perpendicular to direction of tape travel and 0.0001 inch apart.

Azimuth: Perpendicular to the nominal direction of tape travel within 30 seconds of arc.

	IBM 727	IBM 729 IV	8 Channel	16 Channel
Read gap to write gap distance:		0.300"	0.390"	0.390"
Write track width:	0.032"	0.048"	0.032"	0.032"
Read track width:	0.032"	0.030"	0.025"	0.025"
Channel pitch, C to C:	0.070"	0.070"	0.0625"	0.0625"

ELECTRONICS (Optional)

CEC all-transistorized modular read/write electronics is available along with a self-contained and separate power unit. Test points are brought out on the leading edge of the cards for operational monitoring and servicing. Card holder size: 7"H x 19"W x 8 $\frac{1}{4}$ "D.

Read Circuitry: Peak detection read circuitry is employed for maximum reliability. Skew correction is available as a further customer option. Standard outputs are in the form of negative-going six volt pulses capable of driving a 150 ohm load with the following characteristics: Pulse width; 0.75 \pm 0.25 microseconds. Rise time; 0.10 microsecond; a pulse represents a binary one. Other output pulses or levels may be obtained on special order. Lateral and longitudinal parity checking circuitry is available at extra cost.

Write Circuitry: Write circuitry employs NRZ-I (flux change on successive binary "ones") methods for saturation recording. Standard input pulses are identical to the output pulses above. Other input pulses or levels may be obtained on special order. Lateral parity generation circuitry is available at extra cost. Longitudinal parity generation is available at no cost but requires external reset pulse.

IBM-COMPATIBLE SYSTEMS

The DR-2700 is available in IBM 727 (200 bpi) and IBM 729 IV-compatible (555.5 bpi) configurations. Such a system will write and/or read IBM-compatible tapes at speeds up to 112.5 ips consistent with the $\frac{3}{4}$ inch IBM interblock gap. Read electronics is self-clocking. CEC assumes responsibility for IBM compatibility if total system, including read/write electronics, is furnished by CEC. All heads are manufactured by CEC and are fully IBM-compatible. Accessories include IBM-compatible reel hub adaptors, file protect switch, and photoelectric end-of-tape sensors.

CABINETRY (Optional)

A standard CEC cabinet is available and includes doors, filter, and filter grill. A signal connector panel and a 1000 cfm blower are also available.

Cabinet dimensions: 72"H x 23"W x 27"D.

Cabinet weight (with blower): approximately 150 pounds.

NOTE:

All specifications shown on this and the preceding page are subject to change without notice. All specifications are based on using standard CEC test procedures.

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